

arated by being smaller, less robust, having different colored antennæ and legs, a proportionally much longer elytra with a less definite color pattern, and also several other minor differences.

A. nigrolineatus Van Dyke.

A. nigrolineatus Van Dyke, Jour. N. Y. Ent. Soc., 1917, Vol. XXV, p. 36.

Quite robust, somewhat convex, piceous black except elytra which are yellow with basilar margin, a moderately broad common sutural stripe, another, narrower, stripe extending from humeri to apex and joining with the sutural, and a narrow marginal bead of deep black, and the abdominal segments which have a reddish cast. Head and pronotum covered with a fine, sparse, and yet distinct, yellowish pubescence. Apices of elytra slightly pubescent, under surface clothed with a longer and denser pubescence. Head rather finely densely punctate in front, more coarsely so between eyes and on occiput, canaliculate between antennæ. Antennæ five-sevenths as long as body, first joint large, longer than second and third together, third slightly longer than fourth. Prothorax two fifths wider than head, wider than long, base slightly wider than apex, about as wide as head, apex feebly arcuate, base slightly lobed at middle, sides strongly, obtusely tuberculate at middle, disc coarsely and confluent punctured, sides more finely so. Entire surface with a granulate and opaque appearance, with a shallow fovea at middle. Elytral disc very coarsely, but not closely, punctured from base to middle, thence more finely punctured to apex. Length 14 mm.

Mt. Jefferson, Oregon, July 20 (J. C. Bridwell).

The type, a unique male, is in the collection of Dr. Van Dyke. It was collected in the subalpine region of Mt. Jefferson and probably ranges throughout the true fir forest belt of the Southern Cascades.

THE GENERA OF HYDRIOMENINÆ OF THE UNITED STATES (LEP.).

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WORCESTER, MASS.

Our knowledge of the Geometridæ has been much increased since Hulst's paper in the Trans. Am. Ent. Soc., and general ideas of the relative values of the characters he uses are somewhat changed. The following paper is an attempt at a somewhat improved alinement, as well as at a more workable key to the genera, which should avoid the errors which more recent workers have discovered in his tables.

As the primary purpose is if possible to furnish an aid to the identification of North American material, I have based my primary tabulation on the male sex; in Hulst both sexes are necessary for identification. For the same reason I have avoided as far as possible names whose application is, or has lately been in dispute, believing that even a fair proportion of names that would prove synonyms would cause less confusion than a very few, even, which have now or lately been applied to more than one genus. Thus I have dropped a couple of Cramer's and Hübner's names, misidentified by Hulst, and have referred to the species under dispute by names which may prove synonyms on further study, but which I believe at least unambiguous.

The arrangement of the Hydriomeninæ has been made fairly complete for both sexes, as a large proportion of the genera can be defined on other than secondary sexual characters. I have followed the general European usage and treated as a single genus the central mass of species, which show no clean-cut structural characters. An analysis of such characters as I have been able to appreciate, has been added in a note. Some time this genus (*Hydriomena*) will be divided, but not along any lines yet proposed. Hampson's character of the course of the middle discocellular of the hind wing is the most nearly natural of any yet proposed and, in our fauna at least, is correlated with the presence or absence of coremata in the male, but it fails in the cæsiata group. *Silaccata* also belongs by habitus to the group which it least resembles structurally; as the coremata are weak in it it may be a true intermediate. It belongs to a considerable Oriental group, whose genitalia have not been examined.

Hulst's discussion of the characters used in classification leaves comparatively little to be said. I have found the hind tibial pencil less useful than he did, largely because it is often evanescent (as noted by Pearsall in the genus *Epimecis*). Like most secondary sexual characters, if not used cautiously it will separate closely related species. The tuft of the thorax in the *Hydriomena* group is probably a natural character of a certain importance. Practically it is useless, as a very large proportion of available material is rubbed; in fact a large proportion at least of Hulst's *Canocalpes* possess the tuft. At this point I have fallen back on a very unsatisfactory character, the wing-pattern, to separate *Stammodes*, and have let the more typical *Canocalpes* (which in fact have the thoracic tuft) fall back into *Hydriomena*.

The determination of the sexes is in general easy in the Geometridæ. Aside from the fact that the claspers of the male, and ovipositor of the female can usually be seen, the multiple frenulum of the female (which in the Geometridæ is a bundle of bristles of unequal strength) is characteristic, except in *Operophtera*, where it is multiple in the male and the female is wingless. *Operophtera* has heavily fasciculate antennæ unlike any female known to me. The simple frenulum always marks the male in this family. In the Geometrinæ and Palyadinæ it will be necessary to combine the sexes in a single table.

The Dyspteridinæ have been combined with the Hydriomeninæ, for reasons already given by Pearsall; the Monotaxiinæ are based on a single sexual character which occurs in several otherwise unrelated genera, and so the group has been dropped. Hulst's Monocteniinæ are entirely recast, as indicated by Prout in the Genera Insectorum. Of his genera *Melanomma* is a Noctuid, and the other three are Sterrhids of three different tribes.

Notes have been added to the key giving changes in generic content and placing the more important exotic genera. I had hoped to review the South American genera with some care, but Warren's descriptions are so brief that I could make nothing of them, except where I had a chance to see specimens in the U. S. National Museum. Several of his names will have to be used in our fauna, especially in the Boarmid series, and for sections of Hydriomena. Meyrick does not give the condition of the middle discocellular in the hind wing in his papers, so that I was unable to place the genera not represented in the American Museum of Natural History, but I have indicated one or two places where I think his name may have to be used. A surprisingly large proportion of the North American genera are represented in Australasia, in fact the family is more nearly cosmopolitan than any other group I know.

KEY TO SUBFAMILIES OF GEOMETRIDÆ:

- | | |
|---|---|
| 1. Wingless (females) | 2 |
| 1. Wings from about 1/16 inch long to pupal size (females)..... | 3 |
| 1. Wings slightly reduced or normal..... | 5 |
| 2. Hind tibia longer than tarsus, with well developed spurs; moth brown, smoothly scaled..... | <i>Rachela</i> in Hydriomeninæ . |

2. Hind tibia shorter, or with rudimentary spurs; or vestiture overlaid with loose hair, or black and white.....**Ænochrominæ** and **Ennominæ** (2).
3. Abdomen spined dorsally.....*Phigalia* in **Ennominæ**.
3. Abdomen not spined dorsally.....4
4. Front smooth, palpi short.....*Paraptera* in **Hydriomeninæ**.
4. Frontal tuft and palpi projecting beaklike...*Diastichtis* in **Ennominæ** (1).
5. M_2 (vein 5) of hind wings well developed, tubular.....6
5. M_2 of hind wing rudimentary or absent.....11
6. M_2 from decidedly above middle of cell in both wings; our species with enlarged humeral angle, reduced or wanting frenulum; almost always green and always simply marked.....**Geometrinæ**.
6. M_2 at least two thirds as far from top as from bottom of cell in at least one, and usually both wings.....7
7. Sc and R of hind wing fused near base for less than a quarter length of cell, or in contact and immediately and abruptly diverging.....8
7. Sc and A fusing for more than a quarter length of cell, or shortly near end of cell9
7. Sc and R entirely separate, connected by a distinct cross-vein, more than a third way out on cell.....a few **Hydriomeninæ**.
7. Sc and R separate but closely approximate for second fourth of cell, at least, the cross-vein if present obscure and located where Sc and R first approach10
8. Frenulum absent, antennæ clubbed.....**Coronidiinæ** (3).
8. Frenulum and antennæ normal.....**Sterrhinæ** (4).
9. Tongue well developed, one or two well marked accessory cells.
Hydriomeninæ.
9. Tongue rudimentary; radial branches crowded toward origin, not enclosing a distinct accessory cell.....*Alsophila* in **Ænochrominæ** (5).
10. R_1 of fore wing running to costa about $1/16$ inch before apex, no accessory cell; eyes and mouth-parts very small; very hairy; eyes oval..**Brephinæ**.
10. R_1 running to apex; or with normal accessory cell, vestiture, eyes, or palpi and tongue, eyes round.....**Ænochrominæ** and **Ennominæ**.
11. Two large accessory cells in fore wing not connected to Sc.
Grossbeckia in **Hydriomeninæ**.
11. With one or no accessory cells, or with them rhomboidal and the first connected to Sc.....most **Ennominæ**.

NORTH AMERICAN GENERA OF BREPHINÆ.

- M_3 and Cu_1 stalked, at least in hind wing; hind wing white..**Leucobrephos**.
 M_3 and Cu_1 not stalked in hind wing; hind wing orange.....**Brephos**.

NORTH AMERICAN GENERA OF HYDRIOMENINÆ:

MALES:

1. Sc and R connected by a crossvein, Cu_2 extremely reduced in hind wing..2
1. Sc and R fused, at least toward end of cell.....4

14. Hind tibiæ with both pairs of spurs.....16
15. With a single small accessory cell on anterior side of discal cell distinctly before its end; hind wing with Sc and R only shortly fused, but cell closed by a nearly transverse mdev.....**Synomila** (19).
15. Accessory cell reaching end of discal cell, often with M_1 arising from it; fusion of Sc and R in hind wing long.....**Gymnoscelis** (20).
16. Front rounded out half the width of the eyes or more (usually obliquely), close-scaled; small species with single acc. cell, and slight dorsal abdominal tufts like *Eupithecia*.....**Nasusina** (21).
16. Front less strongly rounded out, when most prominent (*Venusia*, etc.) moths of entirely different appearance.....17
17. R_1 running directly across from acc. cell, to Sc, like a cross-vein, the tip occasionally free**Chloroclystis** (22).
17. R_1 free after leaving acc. cell (as a rare aberration very shortly fused with Sc)18
18. A tuft near inner margin of hind wing, opposite end of abdomen.....19
18. No such tuft, the hind wing in our species not sexually modified.....20
19. Tuft black and very conspicuous, covering a hyaline patch; wings less deeply scalloped, male claspers normal.....**Calocalpe** (23).
19. Tuft fuscous and less specialized; end of abdomen broad with large claspers and specialized tufting; the wings more deeply scalloped.
Coryphista (24).
20. Fore wing with a hair-pencil on under side near base.....21
20. No hair-pencil on fore wing.....22
21. Mdev. of hind wing in our species short and straight, wings bluntly rounded.
Polythrena (25).
21. Mdev. long and bent; wings acute at apex.....**Lygris** (26).
22. Hind wings deeply scalloped, the tooth of M_2 about as strong as any.
Triphosa (27).
22. Hind wings with at most a somewhat wavy margin.....23
23. Middle discocellular of hind wing long and bent.....24
23. Mdev. no longer than lower, and straight.....28
24. Antennæ unipectinate**Monotaxis** (28).
24. Antennæ bipectinate, serrate or simple.....25
25. Front rounded and quite smoothly scaled, usually full as wide as eyes, curving in below to clypeus, the palpi hardly exceeding it.....26
25. Front at least rough scaled below, generally, and always when wider than eyes with a distinct conical tuft.....**Hydriomena** (series I) (37).
26. Two accessory cells, antennæ laminate, wings bluntly rounded, black and red**Ænotrus** (29).
26. Two accessory cells, wings more pointed, with simple markings above (the ground color most often yellow) and complexer below; practically all with laminate antennæ**Stamnodes** (30).
26. Antennæ various, accessory cell sometimes single, markings complex on a gray or white ground above, simpler below.....27

27. Branches of radius normally symmetrical on the stalk of R_{3+4} as an axis; two large accessory cells **Epirrita** (31).
27. R_2 arising far beyond R_6 , 1st acc. cell minute or absent..... **Venusia** (32).
28. Front rounded out, curving in to the small clypeus below, and quite smoothly scaled, the palpi hardly exceeding it, our species with one accessory cell **Euchæca** (33).
28. Front rough-scaled or with a conical tuft, or strongly projecting below, with the palpi projecting well beyond it.....29
29. Front fully as wide as eyes, the palpi very rough..... **Loxofidonia** (34).
29. Front narrower than eyes30
30. Hind wing with a distinct though slight angulation at M_3 and notched above, with wavy margin; the antennæ deeply laminate. .
..... **Percnoptilota** (35).
30. Hind wing evenly wavy or rounded31
31. Abdomen with small, usually black dorsal tufts on several segments, fore and hind wings similarly marked with fine wave-lines; front and clypeus often extended to a point below, forming a beak with the palpi.
..... **Eupithecia**, **Eucymatoge** and **Orthonama** (36).
31. Abdomen neither tufted nor black spotted *in the middorsal line*, clypeus never triangular, fore and hind wings only exceptionally similarly marked with fine wave-lines **Hydriomena** (series II) (37).

FEMALES:

1. Wingless or with rudimentary wings..... **Operophtera** (14).
1. Winged2
2. No frenulum, green with two white lines..... **Dyspteris** (6).
2. Frenulum present, not green and simply marked.....3
3. Fore tibia with claw4
3. Fore tibia unarmed5
4. Palpi beaklike **Eucestia** (9).
4. Palpi short, front smooth **Marmopteryx** (10).
5. R_5 and M_1 stalked together from cell in fore wing..... **Zenophleps** (15).
5. R_5 and usually M_1 from accessory cell.....6
6. Hind tibiæ with end-spurs only.....7
6. Hind tibiæ with all spurs9
7. Abdomen with small dorsal tufts (easily lost), hind wing longer to apex than to anal angle **Gymnoscelis** (20).
7. Abdomen smoothly scaled, hind wing full as long to anal angle as to apex..8
8. Fore wing with a single small accessory cell well before end of discal cell, with long oblique udcv..... **Synomila** (19).
8. Fore wing with large or double accessory cell, reaching end of discal cell; udcv obsolete **Trichopteryx** (7) and **Lobophora** (12).
9. R_1 apparently a crossvein, extending from acc. cell to Sc.
..... **Chloroclystis** (22).
9. R_1 free from Sc (or as an aberration very shortly fused with it).....10

25. Abdomen with small dorsal tufts, usually black, front more or less extended below, often into a triangular point; wings similarly marked, with fine wave-lines *Eupithecia*, *Eucymatoge* and *Orthonama* (36).
25. Abdomen smooth scaled, without mid-dorsal black dots, though sometimes with subdorsal ones; clypeus not pointed.....26
26. Wings tawny orange; a single small accessory cell.....*Loxofidonia* (34).
26. Wings not tawny, usually two acc. cells.....27
27. Hind wings slightly angulate at M_3 and excavate above.. *Percnoptilota* (35).
27. Hind wings with evenly wavy or rounded margin.
Hydriomena (series II) (37) and *Lobophora* in part (12).

NOTES.

1. *Diastichtis julia* is very closely related to *loricaria* of Europe, which has a female with very short wings; if ours is similar it will run out here. *D. bicolorata*, which is extremely close to it, however, has nearly fully developed wings.

2. *Alsophila*, *Paleacrita* and *Erannis* in this country. Both larval and adult characters associate *Paleacrita* with the Ennominae rather than the Cœnochrominae (Monocteniinae).

3. The South American genus *Coronidia*, which appears in Kirby's list as a Uraniid is undoubtedly a geometer, as shown by both venation and tympanum. The clubbed antennae and lack of a frenulum would associate it with the Hydriomeninae, which it also resembles in markings, and from which it is undoubtedly derived; as the costal venation of both wings is aberrant, I let it stand by itself. All the species I have seen have the hind wings lobed or tailed on M_3 .

4. The name Acidaliinae cannot stand, as *Acidalia* is preoccupied in the butterflies. *Sterrhina* is unsatisfactory, as *Sterrha* has lately been restricted to the *sacraria* group which violate the definition of the subfamily and only very doubtfully belong to it; but it seems to have priority.

The Cyllopodidæ, as sometimes used, is a composite of yellow species of this subfamily and Dioptidæ: the latter are easily distinguished by the lack of tympanum and differently shaped abdomen, the straight Sc of hind wing not connected with R, and fully developed male hind legs, besides the usually longer upturned palpi and frequent preservation of part of 1st A in the fore wing. In a similar way the more typical Dioptidæ have often been confused with translucent-winged Ennominae.

5. In *Paleacrita* Sc and R of the hind wing are often more or

less fused, and M_2 more or less completely preserved. It may be recognized as an Ennomid by its spined abdomen.

6. Dominantly South American. *Sparta* from Europe is closely related, but has rudimentary tongue and palpi and even more reduced hind wings.

7. The typical group from Europe is extremely close to *Lobophora*, differing from our *limitata* group only in the separation of Sc and R in the male. *Veritata* Pears. is aberrant in its squarer, more thinly scaled wings. The genus is also in South America.

A considerable group of exotic genera will run out here. *Mysticoptera* Meyr. has four spurs and a large folded lobe in the male. In *Siona* (*Schizostege*) the modification on the inner margin is a small pocket, as in *Carsia* to which it is related. The *Rhopalodes* group, of South America, have antennæ distinctly, though slightly, swollen toward the tip; *Rhopalodes* is otherwise like *Trichopteryx*; *Tomopteryx* has an acute fore wing with the outer margin bent at the middle, etc., an outlier is *Tatosoma* of Australasia, which has the same antennæ, a very long abdomen, the lobe spirally coiled, and in the species seen, three spurs on the hind tibia. *Remodes* has more complex structures on the hind wing, and the rare combination of very long palpi and smooth front. For other genera see the "Moths of India."

8. *Nannia morensata* Hulst appears to be *H. (Lygranoa) fusca* of Japan with incorrect locality, but as the type is a female I cannot be sure, it could be a suffused specimen of *refusata*.

Male antennæ bipunctinate, head and wing characters intermediate (group *Lygranoa*) *fusca* (Asia).

Male antennæ fasciculate.

Hind wing with inner margin bent over at base only, forming a rudimentary pocket suggesting *Carsia*, with a hyaline patch farther out, crossed by the root of Cu_1 , and enclosed by the rudimentary root of Cu_2 ; Cu_1 turning at right angles and running to anal angle. Fringe of hair below M_2 slight beyond cell; M_1 and M_2 close together at origin. Female with front as wide as eyes (group *Nannia*).....*refusata*.

Hind wing with a folded lobe at anal angle also, supported by the distinct rudiment of Cu_2 , which runs to anal angle as well as Cu_1 ,—the area crossed by Cu_1 recognizable, but hyaline only in badly rubbed material. M_1 and M_2 widely separate, female with larger eyes (group *Heterophleps*)*triguttata*.

Other types of structure doubtless occur in Asia where the genus is better known as *Dysethia*.

9. Hind tibiae with all spurs.

Costa arched, Sc and R of hind wing normal *Eucestia* (= *Chesias*).

rufata and *spartiata* (Eur.).

Middle of costa straight, habitus of *Carsia*, Sc and R normal (*Anaitis*).

rotundata (Am.) *plagiata* etc. (Eur.).

Hind tibiae with end-spurs only, costa nearly straight (*Scelidacantha*).

triseriata and *virginata*.

Palæoctenis from N. Africa is similar with unipectinate antennæ.

10. A development of the gibbocostata group of *Stammodes*, known to me only from western North America; *marmorata*, *odonata*, and *animata*.

11. Closely related to the typical group of *Hydriomena* in both general structure and genitalia.

12. In this variable mass practically every species has some distinctive structure, often confined to one sex, and there is some individual variation of structure, with the result that a large number of genera have been made. The American and principal Palæarctic species may be analyzed as follows:

Palpi long, beaklike; hind tibiae with end-spurs only, with hair-pencil; Cu_2 of male hind wing well-developed, lobe small (except in *Episauris* from N. Africa) fore wing very large with a fine crisp pattern, most often with green.

Hind wing with R and M_1 stalked in male (*Episauris* Rbl.).

kiliani (Canaries and Madeira).

R and M_1 separate in male only, fore wing marked with green (*Acasis* Dup., *Agia* Hulst.).....*viretata* (Eur.), *viridata* (*eborata* Hulst.).

R and M_1 separate in male, approximate in female.....*appensata* (Eur.).

Palpi slightly exceeding front or short.

Tibiae with end-spurs only, lobe small, wings not very broad, Cu_2 developed in male.

Hind wings with R and M_1 well separated at origin in both sexes.

Hind tibiae with hair-pencil (*Nyctobia*).

limitata, *angulineata*, *nigroangulata*.

No hair-pencil (*Cladara*)*atroliturata*.

Hind wings with R and M_1 stalked in both sexes, fore wings a little broader; with hair-pencil.....*sertata* (Eur.).

Tibiae with all spurs, R and M_1 moderately separate in male, stalked or approximate in female, Cu_2 of male rudimentary.

Lobe very large, free at tip; with hair-pencil (*Lobophora*).

halterata (Eur.). *delogramma* (Austral.).

Lobe very small, truncate.

Hair-pencil on hind tibia (*Oulobophora* Stgr., *Philopsia* Hulst.).

internata and *externata* (Eur.), *nivigerata*.

No hair-pencil (*Tallegaga*).

montanata, *magnoliatoidea*, *canavestita*.

Mysticoptera is similar to the typical group of *Lobophora* but with a single accessory cell (Europe), *Trichopterygia* has a very large single accessory cell, R. and M₁ stalked even in the male, and translucent hind wings.

There are a number of exotic genera connecting this series with the preceding genera on the one hand, and with the central *Cænocalpe* group of *Hydriomena* on the other.

Microloba (*Tyloptera* n. b. l.), from eastern Asia has 2/3 pectinate antennæ in both sexes, one small acc. cell, lobe much reduced and both cubitals apparently lost, as in *Heterophleps*. The position of the discal dot shows that it is a posterior vein, and not R that is lost (*M. bella*).

In *Crocypus* (S. Am.) the lobe is slender, bearing long hair, mdcv of hind wing long and bent, front and wing-vestiture as in *Operoptera* (*C. perlucidaria*).

Erateina is a large genus from South America, forming the connection between *Hydriomena* and *Coronidia*, except for the male structures. Frenulum absent, mdcv. bent, often extremely long, one small accessory cell; hind wing typically with a large lobe, folded under in the male, which becomes reduced to a slight thickening and crimping of the inner margin in species approaching *Trochiodes*. The following species were seen—some of which may really be merely females of others as the sexes are strikingly different in wing form and have often been described as distinct: *leptocircata*, *herbertina*, *drucei*, *undulata*, *zoraida*, *staudingeri*, *rosina*, *sinuata*, *delineata*, *pusaria*, *aroma*, *cometaria*, *lineata*, *artabates*, *flaventia*, *amazonia* (v. *immaculata*), *artemis*, *trisectistrigata*, *rhesa*, *linda*, *catenata*, *hyaloplaga*, *rogersi*, *siliquata*, *dilectaria*, *specularia*, *radiaria*, *substriata*, *cynthia*, *cærulcopicta*, *obscura*, *cornelia*, *proana*, *inexpectata*, *masura*, *sub-sagittata*, and *peloria*.

Trochiodes is practically like the last group of *Erateina*, but the anal angle of the hind wing is shortened and there are two acc. cells, some species have a hair-tuft in the cell of the fore wing. *Pohliata*, *lithosiata*, *cyris*, *cachara*, *prusa* and *pramenea* were seen, all from S. Am.

Rhopalista and *Hammaptera* have more or less the appearance of

Lobophora but the inner margin is merely folded and heavily clothed with hair, some species of the latter grading into *Hydriomena*. *Rhopalista* has a heavy tuft at anal angle above and mdcv. straight but long; the species seen are green and orange. *Hammaptera* normally looks quite like the central group of *Hydriomena*, but normally the discocellular is quite weak, and the apparently thickened inner margin of the hind wing is distinctive. The group with nearly hyaline hind wings are more nearly normal, with long bent mdcv., but the thickened inner margin contrasts strongly.

In *Amygdalopteryx*, as typified by *dulciferata* and *senguera* the pattern is like *Rhopalista*, but the thickened inner margin is obliquely truncate.

Spiloptenia is *Trochiodes* with pectinate male antennæ. (*S. ocellata*, S. Am.).

In *Melitulias* from Australasia, the sex-scaling instead of being confined to the inner margin lies on the flat upper surface of the wing, and tends to be restricted to the costal area. In all these latter genera, beginning with the latter group of *Erateina* the anal is well developed.

13. *C. paludata* and *imbutata*; the latter is represented by specimens from Newfoundland in the Pearsall collection, and easily recognized by its rose shading. Apparently each locality has its recognizable variety, some of which may be worthy of names; *boreata* Pack, applies to the White Mountain form, which is dull and smooth looking, with well contrasted t. a. and t. p. fasciæ.

14. *O. danbyi* is transitional to *Epirrita* in structure and markings. Female wingless, one acc. cell (*Rachela*)...*bruceata*, *occidentalis*, *hyberborea*. Female wings about as long as thorax.

Wings more heavily scaled, tongue shorter than head, normally two acc. cells (*Paraptera*)*danbyi*

Wings very thinly scaled, tongue longer than head, one acc. cell (*Operoptera*)*boreata*, *brumata* (Europe).

Hydriomena (?) *gratulata* will run out here but is distinguished by its normal palpi, frenulum and scaling.

15. Practically synonymous with *Cataclysmæ* of Europe which has simple antennæ. Typical *Zenophleps* intermediate between our species occur in India. *Acodia* of Australasia is marked much like our *obscurata*, but the accessory cell is lost.

- Mdev. of hind wing bent, though short, wings acute, acc. c. at end of discal cell.
lignicolorata.
- Mdev. of hind wing straight, wings rounded, acc. cell before end of discal cell.
obscurata.

16. To judge by the South American fauna *Eudule* is one of a considerable group derived from *Stamnodes* or a closely similar form, in fact the genera seem to intergrade through *Ænotrus*. In some of these the wings are practically normally scaled, but may be distinguished from *Stamnodes*, etc., by the characteristic single large accessory cell. Typical *Eudule* has small hind wings and the abdomen extending well beyond them. Typical examples are *E. pulchricolora*, *venata* and *invargia* (of which *nigricosta* and our species *unigolor* appear to be synonyms). *E. helveta* is transitional to group *Euphanessa*, whose pattern it shows. *Mennis* is a further exaggeration in the same direction where the body exceeds the wings by a fourth its length (*bimacula*, *ficulnea*, *cythena*, *una*, *fidentia*, *bipennis*, *leopardina*, *orsilochia* and *sccata* were seen). These two groups have a distinct tendency to enter mimicking associations. Our eastern species (*mendica* and *meridiana*), with short bodies and ample hind wings belong to group *Euphanessa*, from which group *Leptidule*, of South America differs in the strongly tufted fore wing with distorted venation (*L. medca*, *dulcifera*).

17. There is a strong tendency in all parts of the world for arctic-alpine species of all families to show these characters. In South America such forms have developed from *Stamnodes*, and from its black-marked variant, *Heterusia*; in North America *Euchæca* shows the same tendency, for from genitalic characters this is where "*Hydriomena*" *rubrosuffusata* belongs. It is also very doubtful if our species of *Trichochlamys* are really close relatives. *Hagnagora* (*catagrammina* and *buckleyi* of South America) is easily recognized by its much enlarged tympanic opening and blue-marked hind wing. *Bombia* also has hairy vestiture and simple antennæ; both wings are broad and somewhat lobed at middle of outer margin, and there is a single large acc. cell connected with Sc. *Heterusia* is the South American representative of *Stamnodes* distinguished by the larger area of black, the usually squarer wings, and the strong tendency to develop frontal hair. Our *S. albida* is in all except its lighter coloring, a *Heterusia*. *H. edmondsii* of Chili carries the hairiness to the extreme.

These last three genera differ from *Psychophora* and *Trichochlamys* in the long bent mdcv. of the hind wing.

18. This is undoubtedly *Psychophora* of Curtis; a good series from the Pribiloff Islands which I have seen, agrees exactly with his figures. *Asaphodes* Meyrick is a synonym. The antennal differences are unimportant, and I believe both *Trichochlamys*, and *Dasyuris* Guenée (which has intermediate antennæ) could be sunk to *Psychophora*. *Notorcas* Meyr. from New Zealand is distinctly more hairy. *Stratonice* has a single accessory cell and more plumose antennæ.

Lythria, of Europe, is a parallel development from the group connecting the Hydriomeninæ and Sterrhinæ, it differs in the single small acc. cell not reaching the end of the discal cell.

19. The costal venation and appearance, as well as the hind tibia would place *Synomila* in the Sterrhinæ, but as the fusion of Sc and R of the hind wing is a little long it is also mentioned here.

20. *Minuta* and *remorata*, of our species, belong here; the genus appears to be nearly world-wide but is obscure. It intergrades with *Nasusina*, some of which have the upper tibial spurs much reduced.

21. Hind-tibial spurs very much reduced in *N. mellisa*. The front is bulging as a whole in *N. inferior*, but usually is strongly oblique and extended below, but does not run to a point as so often in *Eupithecia*.

22. I suspect this genus is confined to the Old World, where it is the center of a considerable group (*Elvia*, *Pasiphila*, *Phrissogonus*, etc.). *C. inconspicua* Hulst is an Ennomid.

23. This becomes *Hydria* if the Tentamen be accepted. *Eucosmia* is the same. *Philereme* (*Scotosia*) is hardly distinct but lacks the sexual tufting and is more deeply scalloped; it differs from *Triphosa* in the enlarged tufted claspers. We have no species, *californiata* is a *Triphosa*, though with rather distinct genitalia, and the others listed by Hulst are Hydriomenas (in the broad sense) of various groups. Our single species of *Calocalpe* may have to be separated from the European, as it is social and confined to wild cherry, while the latter is reported as solitary on willow. No differences have been found either in structure or markings of the imago.

24. *Coryphista* is composed of *meadii* with its brown variety *badiaria*, *certata*, etc., from Europe and *affirmata* with its brown variety *bicolor* in South America. *Progressata* from the West Indies may go here, it certainly is not the Californian *Triphosa*.

25. Prout in the "Macrolepidoptera of the World" divides this group as follows, but the differences are not very wide. The whole group has been generally called *Polythrena* in the old world.

Middle discocellular of hind wing angulate.

One acc. cell, no pencil on hind wing; black and orange (*Polythrena*).
coloraria, miegata, angularia (Asia).

Two acc. cells, a pencil on upper side of hind wing as well as under side of fore wing; black and white (*Trichobaptia*).....*exsecuta* (Asia).

Middle discocellular short and straight, one pencil only; black and white (*Trichodezia*) ...*albovittata, californiata, haberhaueri, kindermanni*.

The typical group makes the transition to *Eustroma*.

26. True *Eustroma*, characterized by Prout as having the pencil of hairs arising below A, and the apex of the wings more rounded, does not appear to occur in this country. *Atrocolorata* has the proper type of markings, but has no trace of the hair-pencil. *Photoscotia* (*Lasiogma*) approaches our *nubilata*, but seems to differ in the short straight mdcv. *Neolexia* and *Phylace* are parallel developments from slightly different groups of *Lygris*; *Phylace* has the hair-pencil but it is not very strong. Our species may be grouped as follows:

Male antennæ bipectinate.

Hair pencil normal, markings of *triangulatum* (*Neolexia*).....*xylina*.

Hair pencil weak, markings of *populata* group (*Phylace*).....*luteolata*.

Male antennæ laminate or more or less serrate; pencil normal (*Lygris*).

Pencil massive, a third the length of the inner margin or more, habitus of Oriental species of *Eustroma*.....*cunigerata*.

Pencil moderate in size.....*triangulata* (*prunata* auct.), *destinata*.

(Is this distinct from the last?), *testata, remotata, populata, diversilineata* and the European *prunata, pyropata, associata*, etc.

Male antennæ laminate, pencil forming a long black streak.....*nubilata*.

The last group is possibly transitional to *Photoscotia*.

27. *T. dubitata* does not occur here; our species with strikingly distinct genitalia, but almost identical markings is *indubitata* Grt. *Progressata* Walker seems to be a West Indian *Coryphista*, the western species must become *pustularia*, and its smooth black form is nameless. The difference between it and the eastern form is slight. *Californiata* (*packardata* Gross.) seems to come here, but is a strikingly distinct species.

28. Seems to differ from *Hydriomena* only in the male antennæ, certainly not sufficient to base a subfamily on. The wing-form and pattern agrees with *Ortholitha*.

29. *Enotrus* is not really distinct from *Stammodes*, but the coloring is different. The type species, *dispar*, has much more red than ours, and superficially looks like some *Eudules*. *Emplocia* cannot be used as its type is an Ennomid.

30. *Canocalpe* in part of Hulst, but differing in the smooth front, shorter palpi and in the simple pattern of the upper side. The two genera perhaps represent the most primitive of living Hydrimeninæ. So far as examined the genitalia are also closely similar. In the more alpine species the head and body tend to become more hairy, especially in the closely related South American genus *Heterusia*, and the genus becomes structurally identical with *Hydriomena*. *Lisopsis* is based mainly on the characteristic pattern, and *fervifactaria*, of our species, might be transferred to it. The species of *Xanthorhoë* (*petrophora*) with mdcv. long and bent also show the pattern of *Stammodes*, and I believe, should be transferred to it in spite of their pectinate antennæ; they are *volucer*, *costimacula* and *rubrosuffusa* of our list, *sistenata* and *jaspeata* of the Neotropical, and, I think, *nephelias* Meyr., of New Zealand, if I have it rightly identified.

Callippia is similar, but expands over two inches, the patagia are densely hairy, and there is hair on the palpi and face. *Cophocerotis* is *Stammodes* with unipectinate antennæ; both from South America.

31. Close both to *Venusia* and to *Operophtera*, group Paraptera: the European species *verberata* appears to belong here, making the connection with *Venusia*.

32. I should separate *Venusia* from *Euchocca* by the course of mdcv. of the hind wing rather than the male antennæ, as it correlates much better with the markings and genitalia; both types occur in Europe with two accessory cells, *verberata*, mentioned above with a long bent discocellular, and the genus *Asthena* with short nearly straight ones. Some of the European species seem to grade into typical *Hydriomena*.

Venusia in this sense will separate into three groups by antennal characters: (1) *Venusia* proper, with pectinate antennæ, contains *V. cambrica*; (2) *Nomenia*, with the laminations long and narrow, those of successive segments spaced apart from each other, includes *unipecta* (*12-lineata*), and *secunda*; and (3) a group containing *compertaria*, *pearsalli* (*12-lineata*) in this country, *blomeri* and *decolorata* in Europe and several Indian species. I suspect the name *Hippolyte*

Meyrick is available for this group, but Meyrick fails to mention the middle discocellular veins and I have seen no material of *H. rubropunctaria*. *Baptria tibiale*, generally associated with *Polythrena* on account of its markings will also run here, but its bluntly rounded wings and black ground-color are distinctive. I would hardly dare venture a guess as to its true position, but it has always been associated with the *Polythrenas*.

33. *Asthena* has two accessory cells and is general in the old world. *Minoa* differs in its yellow color, and herbaceous food-plant, but there seems no tangible difference in structure.

34. A variant of *Xanthorhoë*, with which it is connected by an extensive Australasian group ranging into Europe.

35. *Latirupta* and *fluviata* are congeneric, in fact closely similar, though the sexual difference is less striking in the former. I should also include *H. excurvata*. *Multiferata* lacks the characteristic wing form and is quite isolated. It lacks *coremata*, and so would go better here than in the *Xanthorhoë* group of *Hydriomena*. There seem to be close relatives in South America. The genus is world-wide, especially *P. fluviata*, and species connecting it with *Hydriomena* occur in both hemispheres.

36. The typical species of these three genera are distinct enough but there is a complete series of intergrades. *Orthonama* has equal accessory cells, scalloped hind wings and a rather crowded radial system in the fore wing. *Vitalbata*, *intestinata*, *gillettei* and *rectilineata* are typical, but *classicata*, *vancouverensis* and *græfi* are *Eupithecias* except for the two subequal accessory cells. In typical *Eucymatoge* the first accessory cell is minute, perhaps subject to individual variation; our species are *anticaria* and *tenuata*. *Eupithecia* has a single accessory cell, evenly rounded wings, radial system so spaced that the distance from the costal edge to the stem of R_3 and R_4 is much wider than the ordinary distance between two veins in the lower part of the wing, and the clypeus is often extended in a point as in the common eastern *E. miserulata*.

I believe the dorsal tufts are constant in perfectly fresh specimens and outside of India the similarly marked wings with fine wave-lines are characteristic. The tufts are usually black, but white and concolorous in *E. cretacea*. Superficially *H. stellata* is similar, but the black dots on the body are subdorsal.

Coremata of the type that occur in the *Xanthorhoë* group are absent, but there are usually small ones nearer the tip of the abdomen.

37. There remains a considerable mass of species with what may be called the typical Hydriomenid structure, without strong secondary sexual characters except in the male antennæ. Below I have grouped our species, so far as I have seen them, as well as a few of the Europeans, on what characters I could find. Those from the antennæ are generally clean-cut but often separate very closely related species, and the same is true of the single or double accessory cell. The genitalic characters are striking and seem to form natural groups, but I have seen only the eastern species as a rule. The long and bent, or short and straight middle discocellular of the hind wing is widely useful, but in *casiata* and *aurata* it separates closely related species; in fact our *aurata* appears in the list as *casiata*, which seems really confined to the old world. Coremata or membranous eversible organs near the end of the abdomen are general in the group with short middle discocellular, but are rudimentary in *silaceata*, which is also aberrant in markings, and belongs to a mainly Indian group whose genitalia have not been examined.

Of the genera which would run out here the following are the most definable:

Heterusia, of South America, has simple markings above and complex below as in *Stamnodes*, in part of the species the front is smooth and the structure becomes like *Stamnodes*.

Eurhinosea: fore wing broad, subfalcate, one acc. cell. Male antennæ strongly serrate and fasciculate; pale yellow (*flavaria* only).

Ortholitha: Male antennæ pectinate or rarely subpectinate, mdcv. straight, short; moth brown with characteristic markings similar to *Monotaxis*, which it also resembles in having the costa of the hind wing much longer than the inner edge of the fore wing (Palæarctic).

Oligopleura: fore wing produced at apex and sometimes at R_5 , in that case truncate at tip, also at M_3 and concave between, hind wing with M_3 and Cu_1 stalked, or in macrocephala united (South America).

Anchiphyllia: Hind wing strongly falcate on M_1 , male abdomen with side-tufts, otherwise like *Ersephila*, markings of *Monotaxis* (S. America).

Priapodes: Second joint of palpus very long and cylindrical, closely scaled, third joint short; fore legs very long, folded on sides of neck

in repose. Apparently related to typical *Hydriomena* (South America).

Percnoptilota (?): Costa arched, apex marked, antennæ laminate, mdcv. short; 2 acc. cells; fore wing marked with fine striations; no coremata **multiferata**.

Rhodometra (*Sterrha*): One small accessory cell not reaching end of discal cell, as in the *Sterrhinae* (Europe, etc.).

Analysis of *Hydriomena* as restricted above:

1. Middle discocellular vein of hind wing bent sharply, and longer than lower discocellular, or rarely about as long, but markedly bent (*aurata* Pack.).

SERIES I.

2. Male antennæ doubly bipectinate, §1..... **firmata** (Europe).

2. With broad oblique pectinations, plumose, §2..... **turbata** (Europe).

2. Moderate normal pectinations, not extremely oblique.

3. Markings of fine lines as in *Ortholitha*, §3 (*Larentia*).

clavaria Haw. (Europe).

3. Markings of widely spaced lines as in typical *Hydriomena*, §4 (*Carptima*) **hydriomeniata**.

2. Antennæ spatulate-subpectinate, §5 ... **vespertina**, **aqueata** (Europe).

2. Antennæ heavily serrate and fasciculate.

3. Otherwise like typical *Hydriomena*, with R_2 short, anal angle rounded over, etc., §6 (*Ersephila*)..... **grandipennis**, **indistincta**.

3. Wings short with marked anal angle, one acc. cell.... **Eurhinosea**.

2. Male antennæ laminate, ciliate or nearly simple.

3. One acc. cell, palpi fairly long and beaklike.

4. Male antennæ nearly simple and heavily but very shortly ciliate; anal angle of fore wings not distinctly marked; gray without strongly contrasting markings, §7..... **georgii**.

4. Male antennæ deeply laminate (prismatic); anal angle intermediate, markings strongly contrasting, deep brown, suggesting *Eustroma reticulata*, §8..... **atrocolorata**.

4. Male antennæ laminate, anal angle well marked, black and white species (except for suffused arctic specimens), §9 (*Rheumaptera*) **hastata**.

3. Two acc. cells.

4. Inner edge of fore wing generally much longer than outer, the anal angle not well-marked, palpi often long and beaklike, R_2 generally short.

5. Male antennæ deeply prismatic.

6. Uncus simple; with a heavy hook on inner side of clasper; small fragile species generally associated with conifers, §10 (*Thera*).

juniperata, **variata**, **cupressata** (Europe), **simulata** (Holarctic), **contracta** (Am.).

6. Uncus forked, or less often truncate; moths generally heavier, very often marked with green, or with transverse gray bands of moderate width; palpi of various lengths §11 (*Hydriomena*).
- *furcata* (with *sordidata*, *5-fasciata*, etc.), *reflata*, *abacta*, *nubilofasciata*, *cochiseata*, *irata*, *manzanita*, *autumnalis*, *transfigurata*, *californiata*, *banahvarata*, *glenwoodata*, *magnificata*, *ruberata*, *similaris*, etc., from N. Am. and others from Europe and S. Am.
6. Genitalia normal, with slender uncus, palpi barely exceeding front, antennæ not quite so broad, t.a. and p.m. areas normally with yellow or brown patches or bands §12.
- hersiliata*, *formosa*, *ethela*, *brunneata*, *acuata*?¹
5. Male antennæ only slightly prismatic at base, uncus simple, no hook on clasper, median area broadly dark or with a central white patch; palpi long and beaklike §13.
- ✓ *truncata*, *immanata*, *walkerata*, *glacialis*, *patulata*, *occidentata*, *hulstata*?, *mancipata*?
5. Male antennæ moderately prismatic and subserrate, palpi long, R₂ long, moths approaching *Lygris* §14.
- dotata*, *fulvata*, etc. (Europe).
4. Inner edge of fore wing hardly longer than outer, the anal angle generally well-marked, palpi generally short, R₂ long.
5. Fore wing subfalcate, hind wing a little irregularly scalloped, §15 (*Strepsizuga*). *aberrans*, *gavara*, etc. (S. Am.).
5. Fore wing not subfalcate, hind wing even or evenly wavy.
6. Scales of fore wing very narrow, straplike, usually with yellow scales, and with blurred markings (*Entephria*).
7. Mdev. short, though bent, §16.
- aurata* Pack.,¹ *multivagata*, *lagganata*, *takuata* (N. Am.), *flavicinctaria*, *cyanata* and *tophaceata* (Europe).
7. Mdev. long, normal for the group, §17.
- cæsiata* (Europe).
6. Scaling normal, mdev. in our species normal, long.

¹ *Actuata* has the smooth front and short palpi of *Venusia*, but is distinct from all our species in markings and in the two acc. cells. I am unwilling to move it without studying the male genitalia.

² *Cæsiata* apparently does not occur in this country, our species is *aurata* Pack., which preoccupies *aurata* Grote; as the latter comes in a markedly different group, which is likely to be considered a good genus I do not propose a new name for it.

7. Olivaceous brown and white, male antennæ prismatic, §18.

alchemillata, **affinitata**, **minorata**, etc. (Europe).

7. Normally black, blue-gray and white, wings fragile, the outer margin nearly even.

8. Eye smallish, M_2 of fore wing arising well below middle of cell, mdcv. long and bent in both wings, §19.....**gratulata**.

8. Eye full normal size, M_2 on fore wing from above middle of cell. ldcv perceptibly bent, §20 (*Mesoleuca*)**ruficiliata**. and its old-world representative.

albiciliata.

7. Small light species with very long palpi, very long radial branches and usually with a dark median band and a triangular patch below the apex, §21 (*Psaliodes* Guen.).

interrupta Grossbeck and many neotropicals.

7. Normally dull fuscous, the hind wing slightly bent at M_3 , wings heavier, §22 (*Anticlea*).

badiata (Europe), etc., **vasaliata**.

7. Fore wing with fine wave-markings and often yellow scaling, hind wing very often yellow, §23 (*Spargania* Guen.).

aurata and **magnoliata**; **flavolimbaria** of S. America, etc. (**pernotata**, **tæniata**, **parinotata**, **alaskæ**, **occidens**, **oxygramma**, **costiguttata**, **custodiata**, **carnata**, **polygrammata** and **lapidata** of Europe, the type of *Cœnocalpe* Hubn., approach this group more or less closely).

1. Mdcv. of hind wing short and straight, ldcv. often long and oblique; all the species examined with eversible glands on the male abdomen (*coremata*), which are rudimentary in *silaceata*; generally with wings normal in form, with inner margin but little longer than outer, well marked anal angle and even or slightly wavy outer margins, normally with a dark medial area of moderate width (*Xanthorhoë* in the broad sense)**SERIES II.**

2. One accessory cell which is usually more or less abnormal in form.

3. Male antennæ plumose, vestiture largely hairy, accessory cell small, normal (*Loxofidonia*)¹**acidaliata**.

3. Male antennæ pectinate, fore wing with a lobe near base of inner margin, hind wing exceptionally short, §24. **triangularia** (exotic).

3. Male antennæ nearly simple.

³ This may be a synonym of one of Meyerick's New Zealand genera unknown to me; as described some must come very close.

4. Brown, the markings closely similar to *Percnoptilota*, §25.
mirabilata, medeifascia.
4. Black or gray and white, the hind wing usually marked about like the fore wing or black.
 (**Rheumaptera** Hulst, not of Hübner).
5. Eyes smallish, palpi and frontal tuft short, §26.
luctuata (**tristata** of American workers), **tristata** (probably not American).
5. Eyes, palpi and frontal tuft normal, §27.
lugubrata (**luctuata** of American workers), **sociata** (**unangulata** of Packard and others).
4. Eyes smallish, fore wing dark, hind wing yellow; genitalia of *Euchæa*, §28 **Euchæa** (?) **rubrosuffusata.**
2. Two accessory cells (occasionally a single large triangular one as an aberration).
3. Male antennæ bipectinate.
4. Costal edge of hind wing notably longer than inner edge of fore wing **Ortholitha** (Europe).
4. Wings proportionate, §29 (*Xanthorhoë* Hübner, *Petrophora* of the Tentamen; *Larentia* and *Epyra* of Meyrick's New Zealand paper, but not *Larentia* as restricted by Curtis).
incursata, montanata, munitata, borealis, nemorella, convallaria, algidata, defensaria, californiata, labradoriensis, pontiaria, etc., iduata (which is **abrasaria** of American workers).
3. Male antennæ very shortly doubly bipectinate and fasciculate.
4. Pectinations equal and stout, §30 **abrasaria.**
4. Alternate pectinations rudimentary, §31 **fluctuata.**
3. Male antennæ fasciculate and somewhat serrate.¹
4. Wings similar in markings, §32.
stellata (**sitellata** is a misprint).
4. Hind wings simply marked, §33.
designata, intermediata and various exotics.
3. Male antennæ simple or nearly so, not fasciculate or deeply laminate.
4. Hind wings, and often fore wings yellow, §34.
A large old-world group.
4. Fore wings with a more or less contrasting dark median area, hind wings whitish.
5. Coremata rudimentary, §35 **silaceata**
5. Coremata large, §36.
lacustrata, unangulata (probably not American), etc.
3. Male antennæ more deeply prismatic.
4. Larger, dark brown, markings about as in *Triphosa*, outer margin wavy; coremata doubtful.

¹ This is *Gypsochroa* of Hulst, but not of Hübner.

5. Palpi close-scaled and closely upturned to middle of front, the third joint sometimes porrect in death; scales rather narrow as in *Entephria*, with obscure wave-markings on fore wing, §37.....*indefinata*.

5. Palpi moderate, rough, beaklike, hind wings more distinctly scalloped, scales normal, §38.

*neomexicana, australis, etc.*²

4. Small, brown with many nearly straight transverse lines, outer margins even; no coremata.

Percnoptilota (?) multiferata.

The following papers contain keys to the genera of *Hydriomeninæ*:

MEYRICK, E.: A monograph of the New Zealand Geometrina, Trans. N. Z. Institute, 16, 49, 1883. This is the fundamental paper on which our present classification is based.

MEYRICK, E.: Revision of Australian Lepidoptera, IV, Proc. Linn. Soc. New South Wales (2), 5, 791, 1890.

MEYRICK, E.: On the Classification of the Geometrina of the European Fauna, Trans. Ent. Soc. Lond., 1892 (1), 53, 1892.

HAMPSON, G. F.: The Fauna of British India, Moths, III, 329, 1895.

HULST, G. D.: A classification of the Geometrina of North America, Trans. Am. Ent. Soc., 23, 245, 1896.

NOTES ON OSTEN SACKEN'S GROUP "PÆCILANTHRAX," WITH DESCRIPTIONS OF NEW SPECIES.

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The species in this group of *Bombyliidæ* are very difficult of characterization and it may be that some of the described species are local varieties or races. I have had a good series of most of the species to work with. Mr. Knab loaned the National Museum collection in this group which made up a large part of my material, and Mr. Banks and Mr. Walton have loaned me specimens. In the preparation of this paper I am greatly indebted to Mr. Banks for compar-

⁵ *Scotosia gobiata* of New Zealand would run here and may really be related.